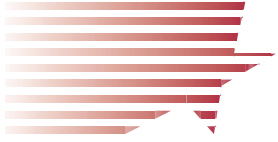# Large Scale Networking (LSN) Strategic Plan FY 2001 and New Visions Workshop

George O. Strawn, NSF
LSN co-chair

Background

- Networking research is needed to:
  - Support the dramatic growth of IT by developing scalable, reliable, secure networking technology and applications
  - Support societal transformations as cited by the PITAC
  - Provide for future networking mission requirements of the Federal agencies

- The Federal agency LSN Strategic plan responds to these research needs.
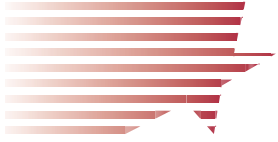
LSN Research Goals

- Goal 1: Network Research

- Goal 2: Network Applications

- Goal 3: Testbeds
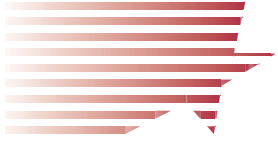
Goal 1: Network Research

- Fundamental Network Research
  - *Agile optical transport networks*
  - *Wireless Technologies*
- Enhancing and scaling networks
- Maximizing access from the edges of the network
- Network security and privacy
- Network management including automated management and resource discovery
- Network modeling and simulation
- Understanding of global-scale networks and information infrastructure
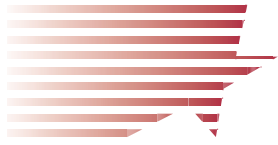
Goal 2: Enabling New Classes of Applications

- Data Intensive Computing

- Collaboration Technology

- Computational Steering

- Distance Visualization

- Workflow management and collaborative problem solving environments

- Remote instrument operation

- Management of large-scale, distributed, multi-institutional systems, e.g., Grid
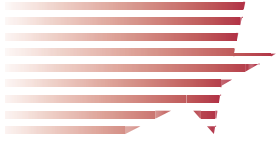
Goal 3: Testbeds

- Cooperative among university researchers, industry developers, and Federal networking agencies

- Focused on bridging the gap between fundamental research and commercial product

- Provide for refinement of standards and technology in a limited environment for application on a broader basis
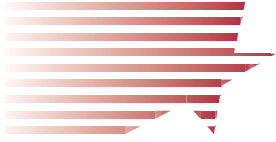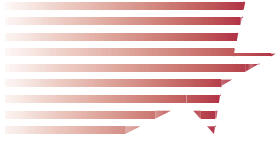
Workshop on New Visions for Large-Scale Networks: Research and Applications

March 12-14, 2001
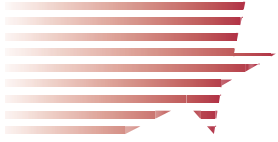
Workshop Objectives

- Develop a vision for the future of networking (10-20 years)

- Develop guidance from the private networking research community on networking research

- Identify needed Federal networking research to enable the visions

Workshop Participation

- The workshop was attended by over 160 participants from:
    - Universities
    - Industry
    - Research laboratories
    - Federal agency networking research organizations

- Workshop participants provided short papers on their vision for networking and networking research needed to enable that vision.

Scenarios for the Future of Networking

- Zero-casualty war: The intelligent, automated, sensornet battlefield

- Smart World: Intelligent aware, secure sensornets for maintenance

- Crisis Management: On-line resources supported by distributed sensors and dynamic networking

- Collaboratories: Proactive, intelligent, dynamic, "natural" interactions

- Networked Medical Care: Distributed medical services/collaboration with high security and high assurance

- High Energy Physics: Collaboration with high-end, on-line resources

Summary of Workshop Findings
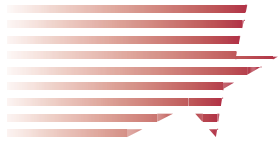# Needed Research Areas

- Adaptive, dynamic, and smart networking
  - Support mobile networking
  - Provide ad hoc, dynamic, high-assurance secure multimedia capabilities
  - Networks responding to applications
  - Resource discovery
- Scalability, measurement, simulation, and modeling
  - New network architectures supporting orders of magnitude increases
  - End-to-end performance measurement and metrics
  - Network modeling to support prediction of network behavior
- Trust, security and privacy
  - Reliability, trust, security, and privacy in dynamic/complex systems
  - Quality of service for critical applications
  - Heterogeneity of interests and sources
  - Trust retractability

Summary of Workshop Findings
# Needed Research Areas, Continued

- Networking applications
  - Applications development and supporting tools
  - Sensornet
  - Telemedicine: distributed, mobile, ubiquitous
  - Hierarchical data delivery
- Middleware
  - Vertically integrated transparent worldwide fabric for processing and information management
  - Integrated management of distributed storage
  - Automated discovery of resources
- Testbeds
  - In close cooperation with the private sector
  - Develop and refine standards
  - Bridge the gap between basic research and commercialization

Summary of Workshop Findings
Needed Research Areas, Concluded

- Collaboration environments
  - Natural, intuitive, ubiquitous access, immersive, trustworthy, on-line access to resources
  - Automatic configuration and resource sharing
- Revolutionary research
  - Basic research in understanding network behavior
  - Adapt research from disciplines of complex systems, e.g. chaos theory, economics, stochastic processes
- Revisit networking fundamentals
  - Research on addressing, routing, forwarding, and transport modes
  - Fundamentals of complexity, performance and technology evolution/revolution Collaboration support
  - Natural, intuitive, automatic, ubiquitous, resource access/sharing
  - Grid
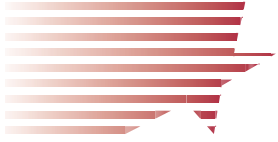
Conclusions

- Our work isn't done: it's scaling up!

- In God we trust: the network not yet...

- Deeper understanding will (as always) lead to additional exciting (and often unexpected) uses

- The Federal government anticipates continuing to play a leadership role in advanced networking

- State governments are now crucial players in the on-going public-private partnership that is continuing the revolution

- www.itrd.gov